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SHORTER ARTICLES AND CORRESPONDENCE

PLEISTOCENE SWAMP DEPOSITS IN VIRGINIA

Buried swamp deposits of Pleistocene age are far more abundant in the Atlantic coastal plain than was suspected a few years ago. A large number of such deposits are exposed by the comparatively recent cutting of the waves along the western shores of the Chesapeake Bay and the estuaries of our southern rivers. These deposits vary greatly in botanical interest from point to point. In some no recognizable remains have been found, in others these are limited to the stumps of the cypress, while still others contain the remains of a considerable flora. It seems evident that quite a number of modern species are more restricted in their northward range than they were during certain interglacial periods or even post-glacial time, while others are extending their range at the present time. Among the former the red bud or Judas-tree (*Cercis canadensis* Linné) and the osage orange (*Tokylon pomiferum* Raf.) might be mentioned, both occurring in the interglacial beds of the Don Valley near Toronto in Canada. Another species abundant as far northward as New Jersey in inter- or post-glacial time was the bald cypress (*Taxodium distichum* Rich.), and the loblolly pine (*Pinus taeda* Linné) also appears to have withdrawn southward since the late Pleistocene. The water elm (*Planera aquatica* Gmel.), on the other hand, appears to have retreated southward in the late Pleistocene and to be readvancing at the present time.

Numerous Pleistocene swamp deposits are described in the recently published account of the Maryland Pleistocene[1] and their contained fossil plants have been admirably exploited by Dr. Hollick, who enumerates over 40 species from beds of this age in Maryland.[2] Similar deposits are to be found at many points in the Old Dominion, although very little attention has been thus far devoted to their description.

In 1906 the writer described[3] *Fagus americana* (nuts) Vitis sp. (seeds), *Hicoria glabra* (fruit), *Taxodium distichum* (seeds and cone-scales) and *Nyssa biflora* (seeds) from the Talbot or latest Pleistocene formation at Tappahannock, Va.

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[1] Maryland Geol. Surv., Pliocene and Pleist., 1906.

[2] *Ibid.,* Systematic Paleont., pp. 217–237, pl. 67–75.

[3] Berry, *Torreya,* Vol. 6, pp. 88–90, 1906.

During the last two years peat deposits of late Pleistocene age have been discovered at numerous points along the Potomac, Rappahannock and James rivers. These usually contain characteristic stumps of the cypress, often of large size, and the associated peat furnishes recognizable plant remains, generally seeds, of Nyssa, Vitis, Fagus and Taxodium, the latter usually the most abundant. Associated with the plant remains are fragments of the elytra of beetles, occasional insect galls and molluscan remains. Evidently most of these Pleistocene peats indicate the presence of cypress swamps, but this is not always the case, since in some instances we find representatives of upland vegetation, while in other cases the fossils show that the vegetation was open and marsh-like with a scattering of trees of oak, birch and pine. Where quiet water conditions followed the subsiding forest-bed, deposits of clay are to be found and these often contain fragments of leaves along with casts of the shells of Unio if the locality is toward the head of the ancient estuary, or shells of *Rangia cuneata* if the waters were more saline. The latter is very abundant in Pleistocene deposits of this sort from Maryland southward and it is also a member of the modern fauna, confined, however, in the latter case to the Gulf of Mexico.

Fig. 1 shows the bed of massive hard peat a short distance above Tappahannock, Va., from which the above mentioned species were collected. It is exposed for a thickness of four or five feet and shows many cypress stumps in place with the "knees" protruding through the recent narrow sand-beach. Overlying the peat is a layer of drab plastic clay from one to four feet thick and carrying fragments of leaves. Above this there is from ten to fifteen feet of coarse sand. The Rappahannock has cut into the bluff along its south bank, exposing this old cypress swamp for a distance of over one half a mile.

Where the forest-bed was succeeded by waters which were agitated by wave action or swift currents the overlying deposits are sands or gravels laid down on the more or less planed surface of the old swamp. Fig. 2 shows such a condition of affairs in an exposure just above the junction of Parrotts Creek with the Rappahannock River. The line of apparent unconformity is sharply defined running across the center of the picture. Below are seen the cypress trunks and roots embedded in an impure peat which was planed off by wave or current action as the

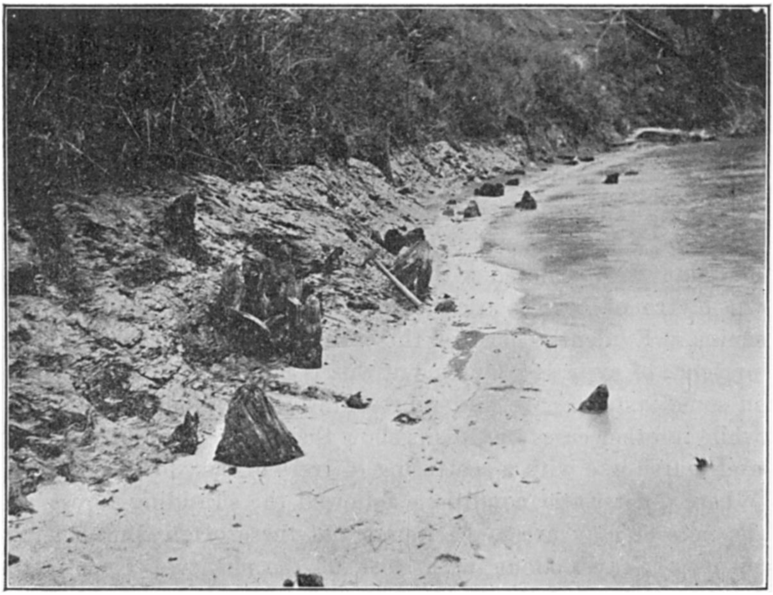

Fig. 1. Talbot Cypress—Swamp near Tappahannock, Virginia.

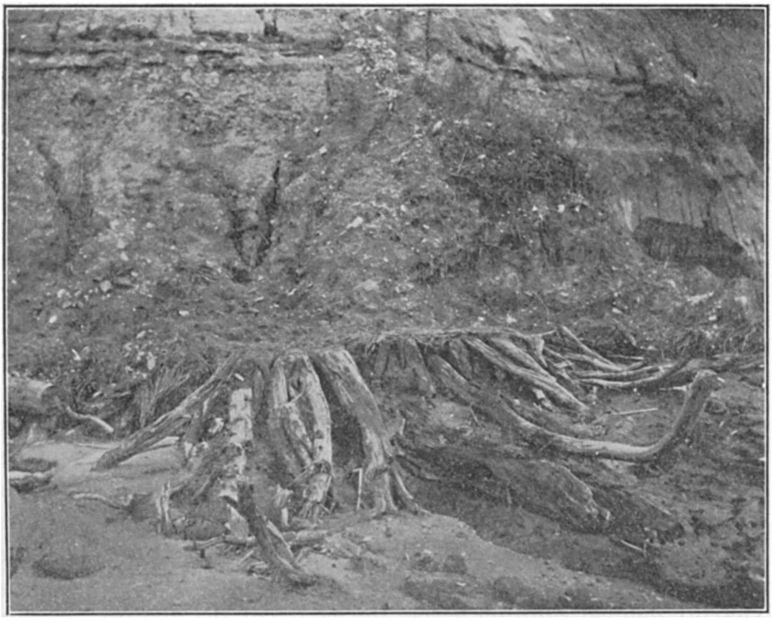

Fig. 2. Talbot swamp deposit just above junction of Parrotts Creek and the Rappahannock River.

swamp subsided. Upon this surface lie the coarse sands shown in the upper half of the photograph.

The additions to the Pleistocene flora of Virginia are enumerated below. Those from below Port Royal were collected by Dr. L. W. Stephenson, of the U. S. Geological Survey, who has also kindly furnished the two photographs here reproduced.

FAGALES

BETULA NIGRA Linné.

Knowlton, *Amer. Geol.*, vol. 18, p. 371, 1896.
Berry, *Journ. Geol.*, vol. 15, p. 341, 1907.
———, AMER. NAT., vol. 41, p. 692, pl. 2, figs. 2–4, 1907.

This riverside and flood-plane species appears to be abundant in the swamp deposits of our southern coastal plain, due doubtless to its abundance along the rivers which contributed their flotage to these deposits. The present occurrence is based upon leaves from the right bank of the Rappahannock River one and one half miles below Port Royal.

QUERCUS sp.

A number of fragments of leaves, evidently those of some oak but too fragmentary for even tentative specific determination, are contained in the collection from the right bank of the Rappahannock River one and one half miles below Port Royal, and undeterminable acorns occur in the Talbot deposits near the Nomini Cliffs on the south shore of the Potomac.

FAGUS AMERICANA Sweet.

Hollick, Md. Geol. Surv., Pli. and Pleist., p. 226, 1906.
Berry, *Torreya*, vol. 6, p. 88, 1906.
———, *Journ. Geol.*, vol. 15, p. 341, 1907.
———, AMER. NAT., vol. 41, p. 692, pl. 2, fig. 7, 1907.
Fagus ferruginea Michx., Lesq., *Am. Journ. Sci.*, vol. 27, p. 363, 1859.
———, Geol. Tenn., p. 427, pl. 7 (K), fig. 11, 1869.
Fagus ferruginea Ait., Knowlton, *Amer. Geol.*, vol. 18, p. 371, 1896.
Mercer, *Journ. Phila. Acad.* (11), vol. 11, pp. 277, 281, fig. 8 (15), 1899.

The characteristic leaves and burrs of this species occur in the Talbot deposits near the Nomini Cliffs. No nuts were found associated with the other remains, but an extended search was not made. This species was one of the commonest trees of the Pleistocene if we may judge from its abundant remains at a large number of localities in Pennsylvania, Maryland, Virginia, West Virginia, Tennessee, North Carolina and Alabama.

CELTIS OCCIDENTALIS Linné.

Bony endocarps, or stones, sometimes enclosed in the lignitized exocarp, and not distinguishable from those of the modern tree, occur in the peat deposits near Tappahannock. In the modern flora this wide-spread species ranges from the Atlantic to the Pacific and from southern Canada to eastern Texas and Florida. It has not heretofore been recorded in the fossil state. The genus dates back to the middle Eocene in this country, but it is not abundantly represented at any horizons. Leaves described as *Celtis pseudo-crassifolia* by Hollick[4] occur in the older Pleistocene (Sunderland) of Maryland. Abroad the genus is commonly represented in the late Tertiary, at least two species being recorded from the Pliocene, but none so far as the writer is aware from the Pleistocene.

SPINDALES

ILEX CASSINE Linné.

This species which in the modern flora is a denizen of low woods and river banks near the coast from Virginia to Florida and west to Louisiana has not heretofore been found fossil. Eight specimens of leaves are in the collection from the right bank of the Rappahannock River one and one half miles below Port Royal. They are identical with the less elongated leaves of the modern plant and would seem to indicate, if their habitat has remained unchanged, that the Talbot coast line was much farther to the west of where it is to-day, a fact fully borne out by the areal distribution of the deposits of the Talbot Sea. They also show that in Talbot time this species ranged somewhat farther north than it does at the present time, since southern Virginia marks its present northern limit according to Sudworth.

ERICALES

DENDRIUM PLEISTOCENICUM Berry.

Berry, *Journ. Geol.*, vol. 15, p. 346, 1907.

Leaves of this species described originally from the Pleistocene of central North Carolina are present from one and one half miles below Port Royal on the Rappahannock River. They are considerably smaller than the North Carolina leaves, but are identical with them in outline and venation and they are also very similar to the leaves of the existing *Dendrium buxifolium* (Berg.) Desv. As previously pointed out, they probably represent the ancestral form from which the modern upland species, *Dendrium hugeri* and the pine-barren species *Dendrium buxifolium* were derived.

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[4] Hollick, *loc. cit.*, p. 230, pl. 71, fig. 9.